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Edition 001

Association of Energy Engineers

THE ENERGY CHRONICLE

ILLUMINATING INSIGHTS, ENERGIZING FUTURES

Association of Energy Engineers-VIT

VIT
Vellore Institute of Technology
(Deemed to be University under section 3 of UGC Act, 1956)

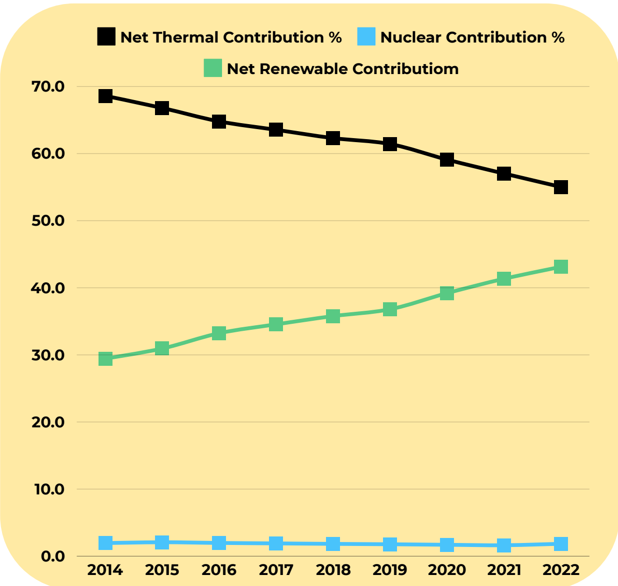
GOING NUCLEAR

An approach to mainstream Nuclear Energy while saving land, money and jobs.

~Abhay Nimbalkar

India’s Energy Situation:

It is certain that coal would continue to fuel India for the near future but government’s decade long push towards renewables and recently made zero-emission commitments provides opportunities to reshape India’s energy policy.



Repurposing of a thermal powerplant into nuclear ones makes sense especially considering the fact that apart from Boiler/Reactor, infrastructure remains mostly the same.

Challenges:

- High Costs and Long Development Timelines: The construction of nuclear plants requires significant capital investment and time.
- Safety Concerns: Addressing safety concerns related to nuclear accidents and waste management is crucial.
- Regulatory and Public Perception: Effective regulatory frameworks and positive public perception are essential for the adoption of nuclear technology.

The Potential of India’s Nuclear Ambitions:

India, with its vast thorium reserves—around 25% of the global total—has a unique opportunity to advance its nuclear ambitions. The country’s three-stage nuclear programmed, initiated in the 1950s, outlines a strategic progression from:

- Natural Uranium-Fueled Heavy Water Reactors (PHWRs): The initial stage uses natural uranium to generate plutonium.
- Plutonium-Fueled Fast Breeder Reactors (FBRs): These reactors use plutonium-239 and natural uranium, designed to produce more fuel than they consume.
- Thermal Breeder Reactors Using Uranium-233: The final stage aims to utilize uranium-233 derived from thorium.

This approach aims to achieve long-term energy independence and optimize the use of India’s extensive thorium reserves.

Economic and Environmental Benefits:

Repurposing coal plants for nuclear energy offers notable advantages:

- Environmental Impact: Nuclear reactors emit minimal greenhouse gases compared to coal plants, significantly reducing air pollution and supporting India’s climate goals under the Paris Agreement, while not harming arable lands.
- Economic Outlook: Although nuclear infrastructure requires high initial investment, it offers lower long-term operational costs and a longer lifespan. The Indo-US Nuclear Deal of 2005 facilitates uranium imports, supporting India’s ambitious nuclear capacity targets—70 GW by 2032 and 275 GW by 2052.
- Manpower trained over thermal plants can be transferred systematically instead of phasing out generations worth of workmanship.

EVENT REPORT:

Decarbonization of the Iron & Steel Industry

Event Date: 22nd June 2024
Platform: Google Meet
Time: 7:00 PM

Organized By: Association of Energy Engineers (AEE), VIT

ABOUT THE SPEAKER:

Dr. Vigneshwaran V S

With extensive interdisciplinary knowledge, V.S. Vigneswaran specializes in areas including the decarbonization of the steel industry, desalination and water treatment, thermal energy storage, and the decarbonization of the sponge iron industry. His distinguished academic record is supported by over eight years of teaching experience and a role as a research associate at TERI

About the Event :

The AEE VIT Student Chapter successfully hosted an insightful session on the decarbonization of the iron and steel industry, a sector known for its significant carbon footprint. The online event, attended by students, faculty members, and industry professionals, featured Dr. Vigneshwaran V S, a distinguished expert in the field.

Industry Relevance :

- The iron and steel industry is a major contributor to global CO2 emissions, making decarbonization crucial for climate action.
- Reducing emissions is essential not only for environmental sustainability but also for maintaining competitiveness in a changing market.
- The event facilitates the exchange of ideas on innovative technologies and policies needed to drive decarbonization efforts.
- It equips future engineers and leaders with the expertise required to lead in a low-carbon industrial landscape.

Key Highlights:

- Technological Innovations: Dr. Vigneshwaran detailed the latest advancements, including green hydrogen and carbon capture, utilization, and storage (CCUS), which are crucial for reducing emissions in the iron and steel industry.
- Policy and Regulation: The session underscored the role of global policies and regulatory frameworks, stressing the importance of international cooperation and government incentives in accelerating decarbonization efforts.
- Sustainable Practices: Attendees learned about the best practices leading companies are adopting to lower their carbon footprint and contribute to a sustainable future.
- Collaborative Efforts: The discussion highlighted the necessity of collaboration among industry, academia, and government to achieve meaningful progress.

Voice of the Grid :

Renewables can sustain nature, but can they sustain The Grid?

Global warming has become a major concern, with countries struggling to meet the Paris Agreement standards. The impact of climate change is evident in record-breaking heat, increased flight turbulence, and melting wax statues. Renewable energy systems are often seen as the solution to the problems created by the Industrial Era.

However, these systems come with their challenges. Wind and sunlight are unpredictable, requiring meticulous maintenance and engineering to ensure a stable power grid. For instance, wind turbines use 15-ton gearboxes to convert low rpm to high rpm for generators, but these gearboxes often fail within seven years, even with costly maintenance. To address this, direct drive systems are adopted, but they cause grid instability due to fluctuating generator frequencies, potentially leading to chaos in the grid. Inverters can address the frequency fluctuations, but they remove the crucial turbine inertia that helps stabilize the grid, leaving it vulnerable to sudden spikes in demand—something coal power plants handle with ease.

Ireland tackled this problem with 120-ton flywheels to store wind energy, but this is not a viable long-term energy storage solution. NREL, USA, has highlighted the use of Fast Frequency Response systems and Synthetic Inertia to solve this problem.

The transition to renewable energy is essential for mitigating climate change, but it requires comprehensive strategies to address its inherent challenges. By investing in innovative solutions and adapting our infrastructure, we can move towards a more sustainable future while maintaining grid stability and reliability.

References:

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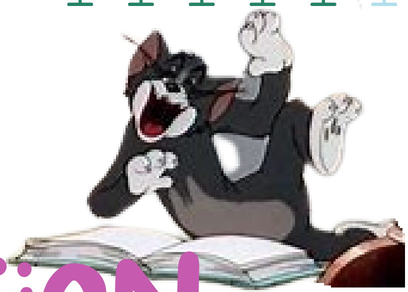
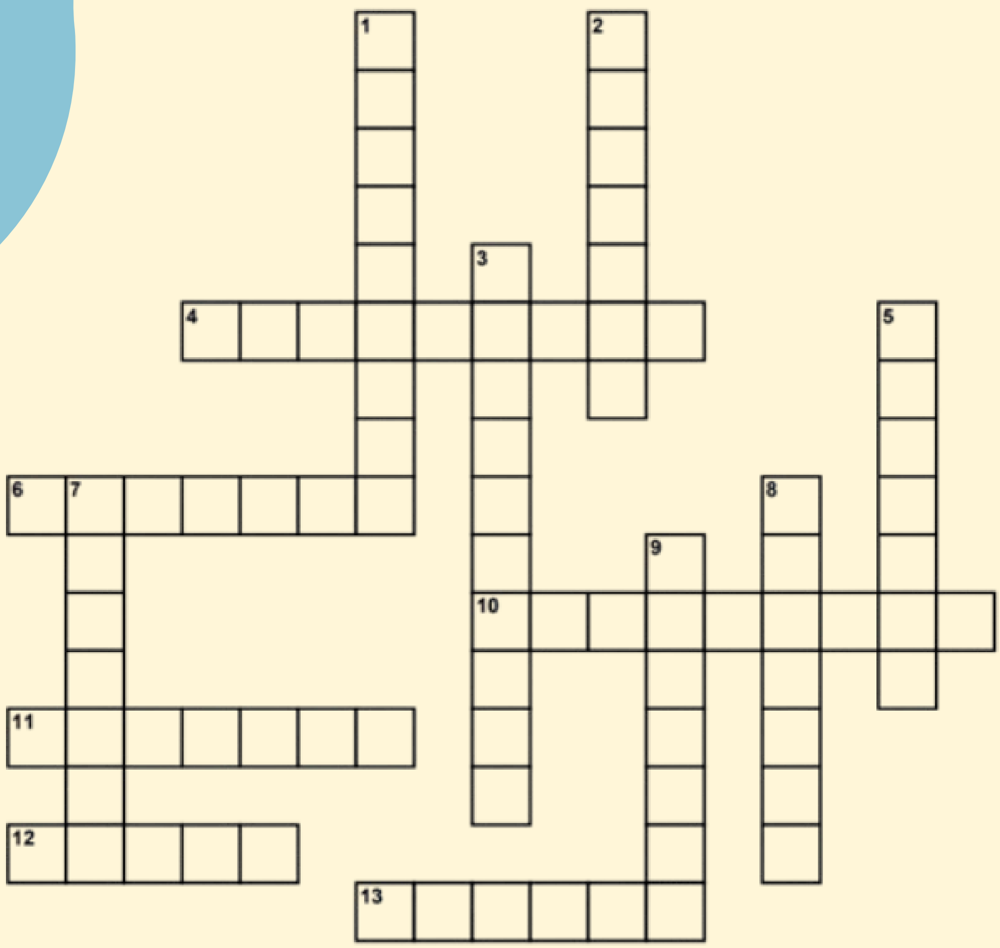
FUN ZONE



CROSS with CONVICTION



Across:

[4] A radioactive element used in nuclear reactors and weapons

[6] The splitting of an atomic nucleus, releasing energy

[10] Material used in a reactor to slow down neutrons

[11] Fluid circulating through a reactor to remove or transfer heat

[12] The process by which a radioactive substance loses energy

[13] The process of combining atomic nuclei to release energy

Down:

[1] Emission of energy in the form of electromagnetic waves or particles

[2] A fertile material used in the nuclear fuel cycle

[3] The process of increasing the proportion of U-235 in uranium

[5] A device used to initiate and control a nuclear chain reaction

[7] Atoms of the same element with different numbers of neutrons

[8] A heavy metal used as fuel in nuclear reactors

[9] A subatomic particle with no charge, found in atomic nuclei